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ELECTRIC LIGHTING

L'Éclairage Électrique. Par le Comte Th. du Moncel. (Paris: Hachette and Co., 1879.)

Electric Lighting and its Practical Application. By J. N. Shoolbred, M.Inst.C.E. (London: Hardwicke and Bogue, 1879.)

The Electric Light in its Practical Application. By Paget Higgs, LL.D. (London: Spon, 1879.)

THE little work, which now appears amongst the numerous volumes of the "Bibliothèque des Merveilles," though containing much more of real information than many of the sketchy works of that popular series, is somewhat disappointing. Like the other writings which the Comte du Moncel has given to the world, it displays a remarkable amount of industrious compilation, but the arrangement of the matter collected is somewhat cumbrous. A far superior book to his recent work on the Telephone, it is nevertheless marred by the same occasional confusion of thought exhibited in that work. It contains, however, in a small compass, a good deal of useful information, and enough serious reading to make it pass as a scientific book.

After fifty pages of generalities the author settles down to discuss the different systems of magneto-electric machines and their comparative efficiency. Next comes a chapter on "*organes excitateurs* de la lumière électrique," which we discover to include carbons of various manufacturers, and materials for lighting by incandescence. Then follow three chapters on regulators, incandescent lamps, and electric candles; after that a *résumé* of the cost of electric lighting; and finally a capital chapter on its numerous applications.

With regard to magneto-electric and dynamo-electric machines, great pains have evidently been taken to give a fair account of most of the systems of importance. In this respect the present work contrasts very favourably with that of M. Fontaine, in which such a disproportionate amount of space is allotted to the Gramme machines. Beginning with the early machines of Nollet, Wilde, Holmes, and Ladd, the successive inventions of Gramme, Siemens, de Meritens, Wallace, Brush, and Lontin are carefully explained, excellent woodcuts of most of these being appended. The "distributing" machines of Lontin, Gramme, and Jablochkoff are also noticed. We take exception to the statement that the Wallace-Farmer machine is merely an enlarged copy of those of Wilde and Lontin. It differs essentially from the former, and in point of date was earlier in the field than the latter. If there be one machine more than another that it does resemble, it is the machine of M. Alfred Niaudet, of which M. du Moncel makes no mention. On the very important question of the relative efficiency of the various systems, M. du Moncel has nothing to say that is new, but simply reproduces the tabular results published by the authorities of Trinity House and by the Committee of the Franklin Institute. His treatment of the question of the cost of electric lighting is even less satisfactory, the figures obtained as the result of the most recent experiments on a large scale in Paris and London being entirely omitted.

In treating of Regulators the author employs a classification deserving of attention. They are divided into six categories, viz.: (1) Regulators founded on the attraction of solenoids, as those of Archereau, Gaiffe, Jaspar, and Brush; (2) those depending on movements worked by electromagnets, as the lamps of Duboscq, Foucault, Serrin, Siemens, and Rapieff; (3) those with large circular carbons, as the regulators of Wright and Reynier; (4) those depending on hydrostatic reaction, as Way's mercurial lamp; (5) those depending on the reaction of the current itself, producing mutual repulsion between the carbon poles; and (6), lastly, those with fixed carbons, such as the electric candle of Jablochkoff. Lamps on the principle of incandescence so-called are treated of under a different head. The plate-lamp devised by Wallace is not mentioned. The following account of the process of manufacture of the Jablochkoff candles is new, and will be read with interest:—

"The manufacture of these candles carried on on a large scale at the Avenue de Villiers, where six or eight thousand a day are made, is really very interesting, especially the manner in which the insulating portions are fashioned. Upon a marble table slightly oiled is spread, by means of a moulding instrument made of a toothed strip of zinc fixed so as to slide in a suitable frame, a thin layer of plaster of Paris mingled with sulphate of baryta, and mixed so as not to set rapidly. This plaster is placed in front of the moulding instrument, which is then moved over the marble slab in such a way as to form grooves and ridges about two metres long. After the moulding tool has been passed backwards and forwards several times, a fresh quantity of plaster is placed in front of the instrument, thus increasing the thickness of the ridges; and at the end of five or six operations of this kind the ridges have exactly the thickness of the teeth of the moulding-tool, or that required for the insulator. The sides of these insulating strips are naturally made slightly concave to receive the carbons, which are cylindrical."

An account of the condensers employed by M. Jablochkoff in conjunction with the alternate-current generators that feed a series of candles, will also be found of some interest. M. du Moncel states that, without these condensers, the candle which has the least resistance of the four on one circuit absorbs so much of the current, that the other three are put out.

We have noticed, in perusing the work, a number of minor blemishes, which, should the book reach a second edition, might with advantage be removed. Thus we are told on p. 13, that Humfry-Davy (*sic*), in 1813, made the first experiments on the production of the voltaic arc, and that this discovery was "completed" by Foucault by the substitution of gas carbon for wood charcoal. If we remember rightly, Sir Humphry Davy's experiment in the Royal Institution, as recounted in the *Philosophical Transactions* for 1809, were made in 1808. Foucault's suggestion came in 1844.

What are we to understand by the following statement on p. 6?—"The *tension* of a current, *which is often nowadays confounded* (these italics are ours) with the *potential*, is the property of the electric fluid which gives in some sort the impulse of the electric movement . . . ." This statement may be put by the side of another on p. 15, that it is possible "to augment the intensity of a gene-

rator at the expense of its tension by condensing the charges."

Passing on to details concerning the light itself, we are told that the heating of the positive carbon to a higher temperature than the negative (an effect which, by the way, depends also upon the diameters of the two carbons) by the battery current does not take place with currents of high tension produced by induction machines. The author makes Professors Ayrton and Perry responsible for the statement that the resistance of the arc is 255 ohms.

Again, on p. 25 we read that the *Bunsen's* cell was discovered in 1839 by *Grove!* And, on p. 34, that to ascertain the resistance of the circuit a rheostat is employed. We had hitherto imagined Prof. Bunsen's battery to be a somewhat later device than that of Sir William Grove, dating from 1842 or 1843, and that for all practical purposes the unreliable rheostat had long been superseded by reliable resistance-coils. We rub our eyes mentally over these little matters.

In one of the appendices some excellent remarks of Mr. W. H. Preece are transcribed entire. In another a brief account of Mr. Edison's patent is copied from the *Standard*, with the following comment:—"This patent, practicable or not, exhibits the usual ingenuity of Mr. Edison, says the *Standard;* for our part we cannot share this opinion, and can see nothing new in the patent. It is a crude idea which does not seem to us likely to lead to any important results."

There is little doubt that to a large class of readers an English translation of this work will be acceptable. It will, however, require careful revision by a competent editor, especially in those passages—numerous to an almost irritating degree—where the reader is referred to the previous works of the author. If this be done the book will fill a useful place at the present time, when so much ignorance prevails as to the nature of the electric light.

Mr. Shoolbred's "Electric Lighting" is an expansion of the papers read by him before the Society of Arts and elsewhere, and professedly deals chiefly with the question from the point of view of practical application. Hence we have in this volume not only the well-known results of experiments on the cost of the light in tabulated form, but also paragraphs on such outlying subjects as photometers, gas-engines, and water-motors. All the principal machines and lamps are briefly described, and many of them figured on lithographed plates. Under the heading of Electric Candles, those of De Meritens, Wilde, and Rapieff are mentioned in addition to the well-known Jablochkoff "candles." Some account is also given of the chief experiments recently made in this country on the various systems of lighting. The manufacture of the carbon pencils for producing the arc is very briefly treated: too briefly, considering that this is the very point in which there exists at present the greatest room for improvement.

Some of the expressions used by Mr. Shoolbred strike us as warranted neither by their scientific accuracy, nor by popular usage. Thus on p. 95 we find, on the question of the subdivision of the light, the following sentence: "The product of each electrical circuit may, it would appear, be fairly considered as the *unit of output*." On p. 96: "The *output* of a machine with regulators does not readily divide itself." This term "*output*," which in these instances, and on p. 11, is used for quantity of current generated by the machine, occurs again on pp. 65 and 66 for the amount of light emitted! The statement on p. 50 that "the very production of the electric light depends upon the conversion of a certain amount of mechanical *duty* into electrical *force*," would certainly draw down the wrath of sticklers for scientific accuracy. The suggestion to produce the voltaic arc between incombustible electrodes so as to avoid the production of nitrous fumes, "and *the very fact* that the use of *carbon* electrodes led to the development of *such baneful emanations*," can hardly be endorsed as a piece of chemical wisdom.

These blemishes, however, and a prevailing inelegance of style, show that a general acquaintance with a scientific subject will not alone qualify its possessor to be regarded as an authority.

For general merit and usefulness the treatise of Dr. Higgs on the electric light in its practical applications will take high rank. Avoiding historical details and points of abstract theoretical interest, the author begins by describing the various lamps and "burners" devised for producing electric light; he then goes on to enumerate the various generators, and to discuss their relative efficiency and economy, illustrating every point where possible by carefully tabulated results of experiment; and concludes with a notice of various useful applications. Many sources of information have obviously been laid under contribution; the report of the Franklin Institute, that of Professors Houston and Thomson, and the very valuable paper of Mr. Preece on the question of multiplication of lights, being reproduced almost entire. The recent and instructive report of Dr. Oelhausen is also quoted in the chapter on Commercial Aspects. Chapter viii. is devoted to electric "regulators," a term which we discover the author to apply to devices, not for regulating the arc, but for controlling the strength of the current. He rejects the term "regulator" in its usual application, preferring to speak of electric "lamps" and "burners." On page 196 is given a table of the various and singularly divergent measurements which have been made of the intensity of illumination of the Jablochkoff candle. A summary of the report of the Gas Light and Coke Company's Committee is also given, and the prejudiced nature of that document is clearly demonstrated. A few blunders require attention. Thus the formula on page 198 for estimating the useful effect of distributed lights is hopelessly wrong. Again, while there is on page 169 a statement that the light is proportional to the current, we find on page 214 a sentence which would lead us to imagine the author's opinion to be that the light was proportional to the fourth power of the current! We doubt, too, whether it has yet been shown that "the hissing noise produced by the electric arc is due to the formation of a vacuum round the incandescent points." The statement that "a tuning fork with its prongs two yards in length will vibrate less than once in two seconds" is misleading, and not necessarily true. These defects apart, the book is a good one; and the illustrations, which are numerous, strike us as being, for the most part, superior to the average of those of scientific books. But why should the

author advertise himself as the *author* of "Electric Lighting," which is the title—if we are not mistaken—of his *translation* of Fontaine's well-known work?

SILVANUS P. THOMPSON

THE DOLOMITE REEFS OF THE SOUTHERN TYROL AND VENETIA

Die Dolomit-Riffe von Süd-Tirol und Venetien. Beiträge zur Bildungsgeschichte der Alpen. Von Edmund Mojsisovics von Mojsvár. Pp. 552, with 30 Photographic Plates, 110 Woodcuts, and an Atlas in 6 sheets. (Vienna: Holder, 1879.)

THERE are few districts in Europe which have attracted so much attention from geologists as that which is described in the splendid monograph now lying before us. Whether we consider the richness and variety of the palæontological treasures yielded by the world-famed deposits of St. Cassian, the wonderfully-dissected volcanic centres of Monzoni and Predazzo, or the remarkable illustrations of the action of denuding forces still at work in the Alpine regions, as illustrated by the picturesque ruin-like masses of the dolomitic limestones and the singular earth-pillars of Botzen, the area must be admitted to be worthy of the celebrity which it enjoys among the cultivators of all branches of geological science.

The author of the present work possesses a remarkable combination of the qualifications necessary for the successful accomplishment of the task he has set himself. A daring Alpine climber, he has explored the most inaccessible recesses of the district during the summer months, while his winters have been devoted to the study of the grand assemblage of fossil-forms which he has brought together with such untiring industry. The manner in which Dr. Mojsisovics is performing this task of describing the enormous series of fossils of the Alpine Trias—an assemblage of forms possessing so many features of interest on account of the remarkable admixture of Palæozoic and Mesozoic types which it presents—is familiar to all palæontologists. He has shown that at Hallstadt and St. Cassian respectively we have evidences of the existence of two distinct life-provinces in the Triassic seas, and his monographs on the cephalopods of these two life-provinces, the first instalments of which have already appeared, have excited the greatest interest among naturalists, who were scarcely prepared even by the writings of von Hauer and other illustrators of the fauna of the Alpine Trias, for the new and remarkable varieties of the Ammonite type, now brought to light by the author of this work. The current number of the *Verhandlungen der k. k. geologischen Reichsanstalt*, of Vienna, contains an interesting summary of this new work, and shows that no less than thirty-two Ammonite genera have up to the present time been recognised in the Alpine Trias, of which thirteen are peculiar to the northern life-province, five are restricted to the southern life-province, while fourteen are common to both. Although Dr. Mojsisovics's work has, up to the present time, been confined to the Cephalopoda, yet we anticipate results of scarcely less interest when he arrives at the examination of the Gasteropoda and the other classes of fossils obtained from the Alpine Trias.

The work before us is in great part the result of the investigation of the Austrian Geological Survey, carried on under the direction of Franz von Hauer, and much of the detailed examination of certain of the districts described was accomplished by two of the author's former colleagues Dr. Hoernes and Dr. Doelter; the account of the volcanic and granitic rocks is indeed almost entirely supplied by the latter geologist, who is so well known for his skill in micropetrographic researches. The most important part of the work, however, is that which is devoted to the description of the several Mesozoic formations of this Alpine area, and to a discussion of the important facts concerning the former physical geography of the region, and the distribution of life-forms within it—questions which the author is so well qualified by his long study of the subject to treat of.

As a consequence of the representations made to the Academy of Sciences of Vienna by von Hauer, Suess, and Hochstetter, a special grant of money was made to aid the author in the publication of this valuable monograph, and no expense has been spared to make both the book itself and the atlas which accompanies it, of the greatest possible value. In these respects the work resembles the publications of the American Geological Surveys much more than those of our own country.

The atlas contains six sheets, comprising an area of about 3,000 square miles, and is constructed on a scale of $\frac{1}{75000}$, or about $\frac{5}{6}$ of an inch to an English mile. The foundation of the map is, for the southern or Italian part, the old general map of the Austro-Hungarian Empire on the same scale, and for the Tyrolese area the new military map of Austria on a scale of $\frac{1}{25000}$, which has been reduced by photography. The geological colouring is admirably printed, and although between forty and fifty different tints have been employed to indicate the numerous subdivisions adopted by the author, this is accomplished without creating confusion, or obscuring the topographical details of the map. The district comprised in it includes the country lying between the Adige and the Piave, from Toblach, on the north, to Feltre, on the south, the larger portion of which is included in the Austrian Tyrol, but a considerable area in the south-west now belongs to the Italian monarchy.

The memoir itself is illustrated by thirty reproductions of photographs taken either by the author himself or by Egger of Lintz, the points of view in the latter cases having been chosen by Dr. Hoernes. These views give an excellent idea of the remarkable natural features presented by this very interesting district, the now famous "Dolomite Mountains." In addition to these views and the very numerous woodcut sections, there is also a series of maps illustrating the areas of the old coral reefs and the lines of disturbance traversing the district.

The first or introductory part of the memoir, consisting of four chapters, gives a general sketch of the geology of the district and of the physical features of the Southern Tyrol. The second part (Chapters V.–XV.) is devoted to a detailed description of the geological structure of the several districts, while the third and concluding part (Chapters XVI. and XVII.) deal with theoretical questions of great interest to geologists at the present time, namely, the reef-theory of von Richthofen and the origin and mode of formation of mountain chains. We regret